

Claims

1. A process for alkylation of an aromatic hydrocarbon or isoalkane with an olefin
5 over the catalysis of a solid acid, comprising contacting a reaction material containing an aromatic hydrocarbon or C₄-C₆ isoalkane, C₂-C₁₈ monoolefin and a compound containing a strongly electronegative element, which serves as an promoter, with a solid acid catalyst to carry out the alkylation, characterized in that the solid acid catalyst is contacted with a compound having a strongly
10 electronegative element prior to its contact with the reaction material, wherein said compound having a strongly electronegative element is identical to or different from the compound containing a strongly electronegative element as promoter.
2. The process according to claim 1, wherein prior to the contact of the solid acid catalyst with the reaction material, said compound having a strongly electronegative element is contact with said catalyst in a form of being comprised in hydrocarbon.
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3. The process according to claim 2, wherein said hydrocarbon comprising a compound having a strongly electronegative element is an aromatic hydrocarbon or
20 isoalkane.
4. The process according to claim 3, wherein said aromatic hydrocarbon or isoalkane comprising a compound having a strongly electronegative element is the reactant of

the alkylation.

5. The process according to any one of claims 1 to 4, wherein said monoolefin is C₃-C₆ monoolefin.

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6. The process according to claim 1, wherein said strongly electronegative element is halogen.

7. The process according to claim 3, wherein in said aromatic hydrocarbon or
10 isoalkane comprising a compound having a strongly electronegative element, the compound having a strongly electronegative element is present in an amount of 10 to 5000 ppm.

8. The process according to claim 7, wherein said compound having a strongly
15 electronegative element is present in an amount of 30 to 3500 ppm.

9. The process according to claim 8, wherein said compound having a strongly electronegative element is present in an amount of 50 to 3000 ppm.

20 10. The process according to any one of claims 1, 2 and 7 to 9, wherein said compound having a strongly electronegative element is an inorganic or organic compound or a mixture of inorganic and organic compounds.

11. The process according to claim 10, wherein said inorganic compound is a hydrogen halide.
12. The process according to claim 11, wherein said hydrogen halide is HF or HCl.
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13. The process according to claim 10, wherein said organic compound is a halogen-containing organic compound having 2 to 8 carbon atoms.
14. The process according to claim 13, wherein said halogen-containing organic compound is a mono- or di-halogenated alkane.
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15. The process according to claim 14, wherein said mono- or di-halogenated alkane is selected from monofluorethane, monochlorethane, 1-fluoropropane, 1-chloropropane, 2-fluoropropane, 1-fluorobutane 1-chlorobutane, 1-bromobutane, 2-fluorobutane, 1,3-difluorobutane, 1,3-dichlorobutane, 1-fluoropentane, 1-fluorohexane, 2-fluorohexane, 1-fluoroheptane, 1-fluoroctane, 2-fluoroctane, 1-chlorooctane or fluoro-isooctane.
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16. The process according to claim 14, wherein said mono- or di-halogenated alkane is fluoro-propane or fluoro-butane.
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17. The process according to claim 3, wherein said isoalkane comprising a compound having a strongly electronegative element is one type of C₄-C₆ isoalkanes,

or a mixture of them.

18. The process according to claim 17, wherein said isoalkane is isobutane.

5 19. The process according to claim 1, wherein said C₄-C₆ isoalkane is isobutane.

20. The process according to claim 1, wherein said aromatic hydrocarbon is benzene or naphthalene.

10 21. The process according to claim 4, wherein said C₃-C₆ monoolefin is butene.

22. The process according to claim 3, wherein prior to contact of said solid acid catalyst with the reaction material, the condition for its contact with the aromatic hydrocarbon or isoalkane comprising a compound having a strongly electronegative element are as follows: the temperature is 10 to 350 °C, the pressure is 0.5 to 10.0 MPa, and the weight hourly space velocity of the aromatic hydrocarbon or isoalkane comprising a compound having a strongly electronegative element is 0.2 to 8 h⁻¹.

15 23. The process according to claim 22, wherein said contact conditions are as follows: the temperature ranges from the supercritical temperature of the aromatic hydrocarbon or isoalkane to 350 °C, the pressure ranges from the supercritical pressure of the aromatic hydrocarbon or isoalkane to 10.0 MPa, and the weight hourly space velocity of the aromatic hydrocarbon or isoalkane comprising a

compound having a strongly electronegative element is preferably 0.5 to 8.0 h⁻¹.

24. The process according to claim 3, wherein conditions for the alkylation are as

follows: the reaction temperature is 10 to 350 °C, the reaction pressure is 0.5 to 10.0

5 MPa, the mol ratio of the aromatic hydrocarbon or isoalkane to the olefin ranges

from 2 to 200, the weight hourly space velocity of the reaction material is 0.1 to 20

h⁻¹, and the compound containing a strongly electronegative element is present in an

amount of 10 to 5000 ppm in the reaction material.

10 25. The process according to claim 24, wherein said conditions for the alkylation are

as follows: the reaction temperature ranges from the supercritical temperature of the

aromatic hydrocarbon or isoalkane to 350 °C, the reaction pressure ranges from the

supercritical pressure of the aromatic hydrocarbon or isoalkane to 10.0 MPa, the mol

ratio of the aromatic hydrocarbon or isoalkane to the olefin ranges from 10 to 90, the

15 weight hourly space velocity of the reaction material is 0.5 to 8.0 h⁻¹, and the

compound containing a strongly electronegative element is present in an amount of

50 to 3000 ppm.

26. The process according to claim 1, wherein said solid acid catalyst is a supported

20 heteropoly acid catalyst, a supported or unsupported heteropoly acid salt catalyst, a

zeolite molecular sieve catalyst, a SO₄²⁻/oxide super acid catalyst, a supported

Brönsted-Lewis conjugate solid super acid catalyst or an oxide or molecular sieve

catalyst treated with a Brönsted acid or Lewis acid.

27. The process according to claim 1, wherein said solid acid catalyst is a supported heteropoly acid catalyst, a supported or unsupported heteropoly acid salt catalyst, a supported Brönsted-Lewis conjugate solid super acid catalyst or an oxide catalyst
5 treated with a Brönsted acid or Lewis acid.

28. The process according to claim 26 or 27, wherein said supported heteropoly acid catalyst consists of a porous inorganic support and a heteropoly acid, wherein the heteropoly acid is represented by the general formula: $H_{8-n}[AM_{12}O_{40}]$, wherein A represents P or Si, M represents W or Mo, and n represents the valence state of A and is 4 or 5; and wherein said supported heteropoly acid salt catalyst consists of a porous inorganic support and a heteropoly acid acid, wherein the heteropoly acid salt is represented by the general formula: $H_{8-n-mx}N_x[AM_{12}O_{40}]$, wherein N is a metal ion selected from alkali metal ions, ammonium ion, alkali earth metal ions and metal ions of Group IIIA metals, m represents the valence state of the metal ion, x is a number usable in the range $0 < mx < 4$, A represents P or Si, M represents W or Mo, and n represents the valence state of A and is 4 or 5; said porous inorganic support being a conventional porous inorganic support selected from activated carbon, silicon oxide, aluminum oxide, magnesium oxide, titanium oxide, natural or synthetic aluminosilicate zeolite, carbon fiber and natural clay, or mixtures thereof.
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29. The process according to claim 28, wherein said porous inorganic support is silicon oxide, aluminum oxide or a mixture of them.

30. The process according to claim 26 or 27, wherein said supported Brönsted-Lewis conjugate solid super acid consists of 40 to 95 % by weight of a porous inorganic support, and 1 to 60 % by weight of a heteropoly acid and 0.3 to 15 % by weight of a
- 5 Lewis acid supported on the porous inorganic support, wherein said heteropoly acid and porous inorganic support are as defined in claim 22; said Lewis acid is selected from AlCl_3 , BF_3 or XF_5 , wherein X represents P, As, Sb or Bi.